zonotip

Operating Instructions

Thickness Gauge

proceq

Made in Switzerland

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1. Safety and Liability

1.1 Safety and Usage Precautions

This manual contains important information on the safety, use and maintenance of the Zonotip / Zonotip+. Read through the manual carefully before the first use of the instrument. Keep the manual in a safe place for future reference.

1.2 Liability and Warranty

Proceq's "General Terms and Conditions of Sale and Delivery" apply in all cases. Warranty and liability claims arising from personal injury and damage to property cannot be upheld if they are due to one or more of the following causes:

- Failure to use the instrument in accordance with its designated use as described in this manual.
- Incorrect performance check for operation and maintenance of the instrument and its components.
- Failure to adhere to the sections of the manual dealing with the performance check, operation and maintenance of the instrument and its components.
- Unauthorized structural modifications to the instrument and its components.
- Serious damage resulting from the effects of foreign bodies, accidents, vandalism and force majeure.

All information contained in this documentation is presented in good faith and believed to be correct. Proceq SA makes no warranties and excludes all liability as to the completeness and/or accuracy of the information.

1.3 Safety Instructions

The instrument is not allowed to be operated by children or anyone under the influence of alcohol, drugs or pharmaceutical preparations. Anyone who is not familiar with this manual must be supervised when using the instrument.

1.4 Correct Usage

- The instrument is only to be used for its designated purpose as describe herein.
- Replace faulty components only with original replacement parts from Proceq.
- Accessories should only be installed or connected to the instrument if they are expressly authorized by Proceq. If other accessories are installed or connected to the instrument then Proceq will accept no liability and the product guarantee is forfeit.

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2. Tutorial

The Zonotip / Zonotip⁺ is designed to measure the thicknesses of ferrous and non-ferrous metals as well as products made of plastics and other materials with a low ultrasonic attenuation. It measures the double traverse of an ultrasonic pulse through the object under test from one surface to the other (see figure 1). This value is then converted into the product thickness value.

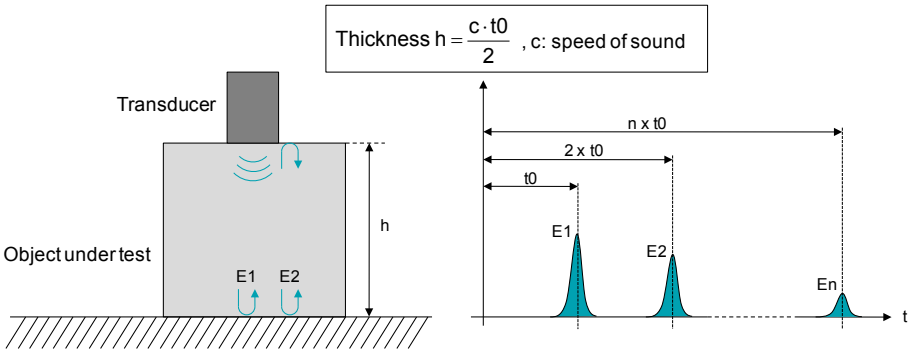

Figure 1: Determining the thickness of an object by means of ultrasound pulse echo technique

The probe has a sharp radiation directivity and ultrasound receiving pattern, therefore, the product thickness is determined directly under the converter installation place. If the material surface opposite to the one on which the probe is installed, has cavities, the US pulses will be reflected from them, and the thickness is determined as the shortest distance from the external surface to these cavities.

The Zonolink Software, included in the package, allows downloading the data measured by the Zonotip / Zonotip⁺ using any PC. Communication with the computer is provided through a USB port.

Practical Advice for Measuring

To receive the maximal measurement accuracy, make sure that the probe, the calibration sample and the test object have roughly the same temperature. If the measured velocity of the material differs from the actual velocity, revise the velocity manually or perform a calibration.

The measurement accuracy directly depends on the accuracy of the velocity setting. For a precise measurement, take a sample of the same material as the test object and set the velocity according to it. For this procedure, use the same US converter as for the actual measurement. If possible, use a plane-parallel sample with smooth surface for the test measurement.

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3. Getting Started

3.1 Overview

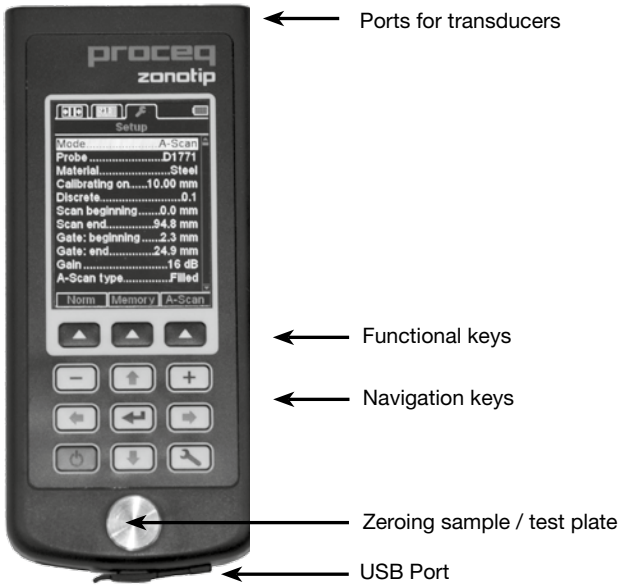

Figure 2: The Zonotip instrument

Figure 3: Connection of the 4.0 MHz transducer. Make sure the red cable is connected to the port with the red dot.

Figure 4: Connection of the 2.5 MHz transducer

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3.2 Connect Probes

The Zonotip is available with two different transducers: The standard 4.0 MHz dual-element transducer is meant for most measurements (see figure 5). It requires two cables, one for the outgoing signal, one for the incoming. The optional 2.5 MHz single-element integrated transducer is smaller and requires only one cable (see figure 6). This makes it more convenient to use in smaller areas or in areas that are harder to access. The 2.5 MHz is included when purchasing the Zonotip⁺ unit. It is also available separately.

Figure 5: 4.0 MHz transducer (D1771)

Figure 6: 2.5 MHz transducer (S3567)

3.3 Overview Keypad

	ON / OFF	Turn the instrument “on” or “off”.
	Functional Key	Carry out various actions depending on the settings. The respective operation is displayed above each of the keys.
	Measurement Mode / Setup Screen	Switch between the measurement modes and the setup screen.
	Enter	Confirm a selection.
	Left / Right	Navigate through the menu.
	Up / Down	Navigate through the menu.
	Plus / Minus	Select and change active parameters.

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3.4 First steps before measuring

After connecting the desired probe, turn on the instrument.

Click to enter the setup screen (see figure 7).

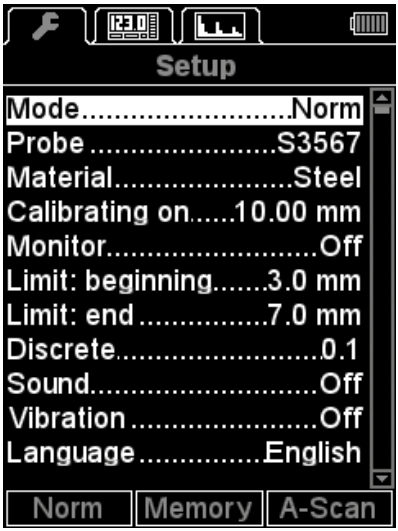

Figure 7: Setup-Screen

- Select the desired mode - Norm, Memory, A-Scan (Zonotip⁺ only). The different modes are explained in chapter 4.1.
- Select the probe which you have connected. A text will appear on the screen. Please follow these instructions. This process is needed to calibrate the instrument before the first measurement.
- Please put a little coupling paste onto the built-in zeroing sample (test plate) of the Zonotip (see figure 2). The thickness of the zeroing sample is 5 mm.
- Select the material you are about to test.

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4. Use of the Instrument

4.1 The Different Measuring Modes

4.1.1 Overview of Settings / Menu Structures

The Zonotip / Zonotip⁺ features different measuring modes that can be set in the Setup-Screen: the Norm mode, the Memory mode and the A-Scan mode (Zonotip⁺ only).

Measuring Mode

Norm		Memory		A-Scan	
Mode	1	Mode	1	Mode	1
Probe	2	Probe	2	Probe	2
Material	3	Material	3	Material	3
Calibrating on	4	Calibrating on	4	Calibrating on	4
Monitor	5	Monitor	5	Discrete	8
Limit: beginning	6	Limit: beginning	6	Scan beginning	15
Limit: end	7	Limit: end	7	Scan end	16
Discrete	8	Discrete	8	Gate: beginning	17
Sound	9	Clear Memory	14	Gate: end	18
Vibration	10	Sound	9	Gain	19
Language	11	Vibration	10	A-Scan type	20
Measuring units	12	Language	11	Sound	9
Brightness	13	Measuring units	12	Vibration	10
		Brightness	13	Language	11
				Measuring units	12
				Brightness	13

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All Modes					
	Mode	1	Norm		
			Memory		
			A-Scan		
	Probe	2	Test		
			Open	D1771 4.0 MHz	
				S3567 2.5 MHz	
	Material	3	Open	New, Aluminium, Gold, Brass, Copper, Ice, Polyethylene, Lead, Silver, Steel, Plexiglass, Glass, Titan	
	Calibrating on	4	Run	for details see 4.3.2	
			Edit		
	Monitor	5	Inside		
			Off		
			Outside		
	Limit: beginning	6	Edit	for details see 4.3.2	
	Limit: end	7	Edit	for details see 4.3.2	
	Discrete	8	0.1	Select the number of decimals	
			0.01		
	Sound	9	On		
			Off		
	Vibration	10	On		
			Off		
	Language	11	English	to change the language, please press the functional keys multiple times.	
			German		
			French		
			Italian		
			Portuguese		
			Spanish		
			Chinese		
			Russian		
	Measuring units	12	mm		
			inch		
	Brightness	13	+		
			-		

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Memory	Clear Memory	14	Run	The % amount represents the used memory capacity

A-Scan	Scan beginning	15	Edit	for details see 4.3.2
	Scan end	16	Edit	for details see 4.3.2
	Gate: beginning	17	Edit	for details see 4.3.2
	Gate: end	18	Edit	for details see 4.3.2
	Gain	19	Edit	for details see 4.3.2
	A-Scan type	20	Filled	
			Empty	

4.1.2 Norm Mode

Using the Norm mode is convenient when the measurement results do not have to be recorded. This mode enables the Zonotip to promptly determine the thickness of the test object and to set the “monitor” (5) response range. If “monitor” (5) is set to “inside” and the readings are within the defined limits, the readings are shown in red. If “monitor” is set to “outside” and the readings are within the defined limits, the readings are shown in white.

1.	Active bookmark of Norm mode
2.	Battery charge indicator
3.	Measurement units
4.	Measurement results
5.	Indicator of the measurement taking method (see chapter 4.2.1)
6.	Indicator of the signal level (see chapter 4.2.1)
7.	Current Probe
8.	Lower limit
9.	Upper limit
10.	Current material
11.	US waves velocity in the current material

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4.1.3 Memory Mode

The Memory mode of the Zonotip / Zonotip⁺ allows to promptly determine the thickness of the test object, to record the measurement in the memory of the instrument, to browse them on the display as well as to correct the entries and to conduct re-measurements.

The screen is divided into two parts: the upper part displays information about the measurement, the lower part shows information about previously saved results.

Up to 500 cells (single measurements) can be stored in up to 100 groups. If the maximum number of cells in a group is reached, a related information caption will appear on the instrument screen.

To store a measurement, please press (↵).

1.	Active bookmark of the Memory mode
2.	Battery charge indicator
3.	Measurement units
4.	Measurement result
5.	Indicator of the measurement taking method (see chapter 4.2.1)
6.	Indicator of the signal level (see chapter 4.2.1)
7.	Number of group
8.	Number of measurement
9.	Stored measurement results

Editing Stored Measurements

1. Press the (→) key to enter the edit mode. The screen will show ❄.
2. Use the keys to (↑) (↓) to select the measurement that needs to be overwritten.
3. Press the (→) key to start a new measurement.
4. By pressing (↵), the measured data will be stored (the old data will be overwritten).
5. Press (←) to exit the edit mode.

Transferring data

Please note that device needs to be in Memory Mode in order to communicate with PC, refer to section 6. Zonolink

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4.1.4 A-Scan Mode (Zonotip+ only)

The A-Scan mode allows excluding measurement inaccuracies, caused by e.g. flaws or cracks in the test object. The signal is visualized on the display as an A-Scan, which allows a more indepth analysis of the reading.

The A-Scan mode features the following measurement options:

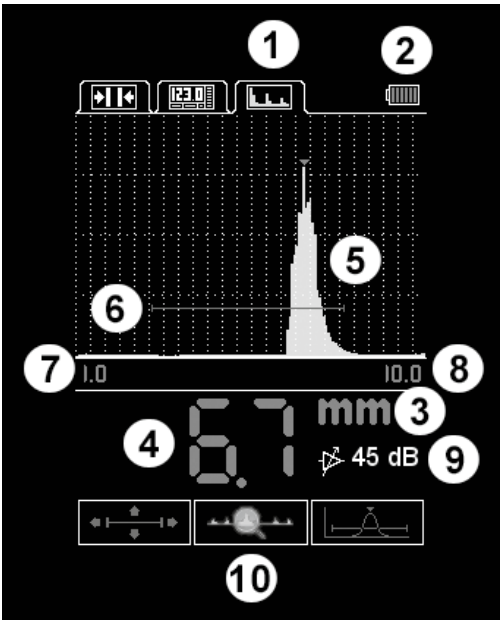
- thickness of a test object even if it contains flaws or cracks
- general flaw and crack detection
- bond quality of layered materials, including delamination detection
- thickness of layered materials

It is also possible to zoom in on an arbitrary location of the A-Scan in order to interpret the measurements better. Furthermore, the horizontal and vertical position as well as the length of the gate (red horizontal bar) can be adjusted. The gate feature is especially useful for situations where several echos appear in the A-Scan. Therefore, the gate must be moved to the echo that needs to be evaluated.

The screen is divided into two parts: the upper part shows the signal, the lower part displays the numerical values of the parameters and the operation pictograms (see chapter 4.2.2).

The results of the A-Scan measurement are saved at the end of the last used measurement group. The latter is created in the Memory mode (see chapter 4.1.3). To view the saved A-Scans, switch to the Memory mode. The saved A-Scans have the symbol to the left of the test results.

i When returning to the A-Scan mode, the graphic image of the A-Scan will be lost.



1.	Active bookmark of A-Scan mode
2.	Battery charge indicator
3.	Measurement units
4.	Measurement results
5.	A-Scan signal
6.	Gate
7.	Scan beginning
8.	Scan end
9.	Gain
10.	Operation pictograms (see chapter 4.2.2)

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Using the Keys in the Active mode

Operation Pictogram	Key	Purpose
	+ −	Change of gate length
	↑ ↓	Vertical position of the gate
	← →	Horizontal position of the gate
	+ −	Zoom in on the A-Scan
	↑ ↓	Set the signal gain in decibel
	← →	Horizontal scrolling of the signal on the screen
	↑ ↓	Set the signal gain in decibel

4.2 Pictograms

4.2.1 Signal Strength Indicators and Measurement Method (Norm Mode and Memory Mode only)

Signal level is maximal

Signal level is average

Signal level is minimal

No signal

No measurements

Measurement using the ACF method (see chapter 4.2.2)

Measurement using the threshold method (see chapter 4.2.2)

Overwrite mode (see chapter 4.1.3)

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4.2.2 Operation Pictograms A-Scan (Zonotip⁺ only)

Change gate parameters

Select signal section to be displayed

Selection of the measurement method: the instant the signal within the gate exceeds the threshold (vertical position of the gate) is used for the measurement.

Selection of the measurement method: the distance between the peaks of two signals within the gate is used for the measurement.

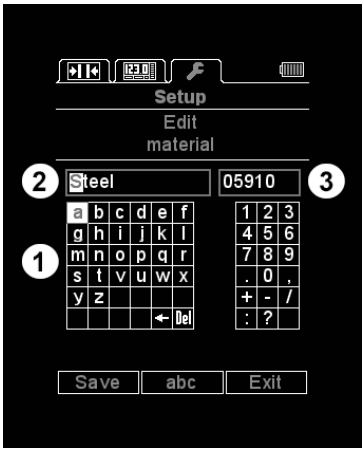
Selection of the measurement method: the peak of the signal within the gate is used for the measurement.

Selection of the measurement method: Auto Correlation Function (ACF) is applied to the signals within the gate.

4.3 Setup-Screen

4.3.1 Create a New Material / Edit a Material (Applicable for all Modes)

The Zonotip / Zonotip⁺ can store up to 64 different materials. Enter the “Material” menu to create or edit a new material. Select “Create” or “Edit” on the screen.



Use the ← → ↑ ↓ keys to scroll in the table of symbols (“1”). Press the ↵ key to choose a symbol.

Use the − + keys to edit the lines (“2” and “3”).

To jump from the left to the right box (from “2” to “3”), position the cursor on the first position of the left box and press the − key.

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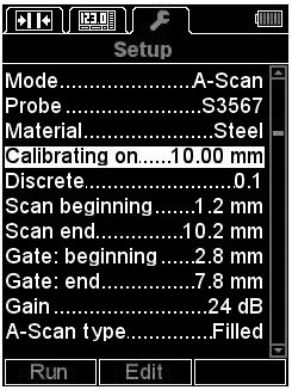
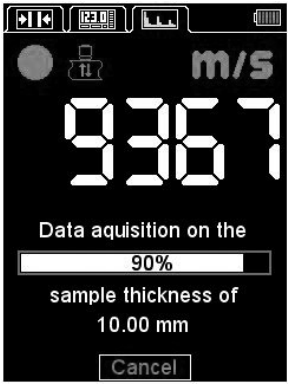
4.3.2 Calibration on known Material / Determinate the US velocity

To determine the velocity of an US wave in a material with a known thickness, use the “Calibrating on” function in the setup screen.





Enter the thickness of the sample with “Edit” and start the calibration process by pressing “Run”. The sample thickness should be within 2.0 - 80.0mm (0.078 - 3.15 inch).

Once the data acquisition is finished, the velocity and material can be saved and added to the database of the instrument (see 4.3.1.).

4.3.3 Overview of Different Setup-Items

Calibration On	4	All Modes	Designed for determining the velocity of an US wave in a material with a known thickness	2.0 - 80.0 mm (0.078 - 3.15 inch)
Monitor	5	All Modes	Set response conditions for color, sound or vibration alarm	• Inside: results are within the set interval • Outside: results are not in the set interval • Off: monitor is switched off
Limit: beginning	6	All Modes	Set the lower limit of the “monitor”	0 - 150 mm (0 - 5.9 inch)
Limit: end	7	All Modes	Set the upper limit of the “monitor”	1 - 300 mm (0 - 11.8 inch)
Clear Memory	14	Memory	Erasing the measurement results	
Scan beginning	15	A-Scan	Set the beginning of the reflection area on the screen	0 - 150 mm (0-5.9 inch)
Scan end	16	A-Scan	Set the end of the reflection area on the screen	5 - 300 mm (0.2 - 11.8 inch)
Gate: beginning	17	A-Scan	Set lower limit	0 - 150 mm (0 -5.9 inch)
Gate: end	18	A-Scan	Set upper limit	1 - 300 mm (0 - 11.8 inch)
Gain	19	A-Scan	Set the amplification of the instrument inlet path	0 - 80 dB
Type of A-Scan	20	A-Scan	Selection of the signal reflection type	• Fill: reflected in the filled type • Outline: reflected in form of an outline

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5. Velocity of Longitudinal Ultrasonic Waves

Material	Velocity [m/s]
Chrome	6845
Zinc	4170
Basalt	5930
Vanadium	6000
Bismuth	2180
Tungsten	5460
Iron	5850
Gold	3240
Constantan	5240
Brass	4430
Capron	2640
Ice	3980
Manganine	4660
Marble	6150
Silver	3600
Lead	2160
Tin	3320
Nickel	5630

Material	Velocity [m/s]
Copper	4700
Molybdenum	6290
Aluminum	6260
Ebonite	2400
Osmium	5478
(Phosphor) bronze	3530
Limestone	6130
Ceramized glass	6740
Steel 20	6060
Steel 15	5400
Steel 40	5600
Steel 70	5960
Steel 35	5680
Tantalum	4235
Manganese	5561
Magnesium	5790
Cast iron	3500 - 5600
Labradorite 44	5450

Material	Velocity [m/s]
Concretes	2000 - 5400
Gabbro 38	6320
Plaster stone	4790
Foliated granite	7870
Granite	4450
Diabase 85	5800
Dolomite	4450
Fused quartz	5930
Plexiglas	2670
Polystyrene	2350
Rubber	1480
Mica	7760
Organic glass	2550
Silicate glass	5500
Teflon	1350
Steel St3	5930
Textolite	2920
Porcelain	5340

6. Zonolink

Control Panel

If this icon is in color - there is a connection to the instrument.

If this icon is in greyscale - there is no connection to the instrument.

If there is a connection, the process of data receiving from the instrument can be launched.

saving the data to the PC.

request the online help.

request the information about the application.

Loading the data

- Turn on the thickness gauge.
- Set the device to Memory Mode.
- Connect the thickness gauge to the PC using a USB cable.
- Press the button (in color).

i	Please note that the device is in the Memory Mode; otherwise the device will not connect to the PC, enabling you to transfer your data.

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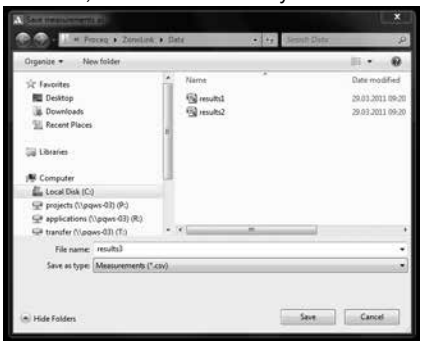
- The process of data receiving will be launched.
- If the data is transferred successfully, the message “The data from the instrument was fully received” will appear, and the data will be displayed.

Saving of the received data on the PC

- Press the button .
- In the window «Save as» name the file and indicate the path for saving.

By default, the software will save the data to the folder where the application is installed. However, the user can select any folder to save the data in. The default name of the file will have the format «resultsX», where X is an index number. The index number is generated automatically from the numbers that are missing in the selected folder. For instance, if there are files «results25» and «results27» in the folder, the software will advice to save the file with the name «results26». However, the user can set any name for the data file.



The software will save the files in the *.csv format, which can then be opened in programs such as Excel or Notepad.

Shutdown

Press the button
If the changes were not saved, the software will warn about that.

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To save the data, press «Yes». The software will open the window for data saving.
To exit the software without saving the changes press «No».

To return to the application press «Cancel».

7. Technical Specifications

Instrument		
Operating temperature	-20 °C to 50 °C (-4 °F to 122 °F)	
Humidity	up to 85% RH with a temperature of 25 °C (77 °F)	
Battery operation period	9 h	
Power	built-in LiPol accumulator	
Operation supply voltage	3.7 V	
Dimension	157 x 70x 23 mm (6.1 x 2.7 x 0.9 inch)	
Weight	250 g	
Display type	TFT	
Permissible surface roughness	Rz160 / N12 / Ra = 50 µm	
Minimum curvature radius	10 mm (0.4 inch)	
Ultrasonic velocity range	from 1000 to 9999 m/s	
Data memory	100 groups each max. 500 measurements	
Interface type	USB	
Thickness resolution	< 99.99 mm: 0.01 mm	
	> 100.0 mm: 0.1 mm	
IP Classification	IP52	
Transducer		
Type	Dual-element	Single-element
Frequency	**4.0 MHz**	**2.5 MHz**
Measurement range (steel)	0.7 - 300 mm	0.7 - 300 mm
Diameter of ultrasonic element	16 mm (0.6 inch)	10 mm (0.4 inch)
Connector type	LEMO type 00.250	LEMO type 00.250
Size	45 x ∅23 mm (1.8 x ∅0.9 inch)	24 x ∅16 mm (0.9 x ∅0.6 inch) (∅18.5 at the connector)
Weight	23 g	16 g

Standards and Regulations Applied

- ASTM E 797
- EN 15317

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8. Part Numbers and Accessories

8.1 Units

Part No.	Description
790 10 000	**Zonotip** unit consisting of: Indicating device with calibration sample, transducer 4.0 MHz, transducer cable 2pol 1.2 m, couplant, battery charger with USB cable, carrying strap, data carrier with software, documentation, protective pouch, carrying case
790 20 000	**Zonotip*** unit consisting of: Indicating device with calibration sample, transducer 4.0 MHz, transducer cable 2pol 1.2 m, transducer 2.5 MHz, transducer cable 1pol 1.2 m, couplant, battery charger with USB cable, carrying strap, data carrier with software, documentation, protective pouch, carring case

8.2 Parts and Accessories

790 11 001	D1771 Ultrasonic Transducer 4.0 MHz
790 12 001	S3567 Ultrasonic Transducer 2.5 MHz
710 10 031	Ultrasound couplant, 250 ml
790 80 001	Step Test Block (inches)
790 80 002	Step Test Block (mm)

9. Maintenance and Support

9.1 Support Concept

Proceq is committed to providing a complete support service for this instrument. It is recommended that the user registers the product on the www.proceq.com to obtain valuable information on available updates and other useful information.

9.2 Standard Warranty and Extended Warranty

The standard warranty covers the electronic portion of the instrument for 24 month and the mechanical portion of the instrument for 6 month. An extended warranty for one, two or three years for the electronic portion of the instrument may be purchased up to 90 days of purchase.

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